

[Claim(s)]

[Claim 1] The paper leaf double-feed-prevention member which comes to construct a bridge over the rubber constituent which contains 5 or more sections the ultra high molecular weight polyethylene of the 100 or less section to the base material rubber and this base material rubber 100 section.

[Claim 2] The paper leaf double-feed-prevention member according to claim 1 whose weight average molecular weight of the above-mentioned ultra high molecular weight polyethylene is 1 million or more.

[Claim 3] The paper leaf double-feed-prevention member according to claim 1 or 2 whose loadings of the above-mentioned ultra high molecular weight polyethylene are 10 or more-section the 50 or less section to the base material rubber 100 section.

[Claim 4] A paper leaf double-feed-prevention member given in any 1 term of claim 1 to claim 3 whose principal component of the above-mentioned base material rubber is an ethylene-propylene-diene copolymer.

DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to paper leaf double-feed-prevention members, such as a separation pad used for feed devices, such as a copying machine, a printer, and facsimile, a separation roller, and a separation sheet.

[0002]

[Description of the Prior Art] By the general feed device, paper leaf, such as a PPC form and a transparency sheet, is stored in several multi-sheet tray, and this paper leaf passes through between a feed roller and separation pads, and is sent to an image formation device. Coefficient of friction of a feed roller and paper leaf must be larger than coefficient of friction of paper leaf. One paper leaf is certainly separated at a time by this, it is sent to an image formation device, and the so-called double feed is prevented.

[0003] Moreover, by this feed device, coefficient of friction of a separation pad and paper leaf must also be larger than coefficient of friction of paper leaf. Thereby, when the remaining number of sheets of the paper leaf in a tray becomes few (for example, about several sheets), it is prevented that all the remaining paper leaf will be sent at once (namely, double feed).

[0004] By this feed device, coefficient of friction of a separation pad and paper leaf must be still smaller than coefficient of friction of a feed roller and paper leaf. Thereby,

generating of the paper leaf of the last in a tray no longer being sent (the so-called paper remainder) is prevented.

[0005] That is, it sets in this kind of feed device, and coefficient-of-friction  $\mu_R$  of friction \*\*\*\*micro F of a feed roller and paper leaf, a separation pad, and paper leaf and coefficient-of-friction  $\mu_P$  of paper leaf are following formula  $\mu_F > \mu_R > \mu_P$  for coexistence with double feed prevention and the paper remaining prevention. ... (I)

It is necessary to come out and to have the relation expressed. For example, when paper leaf is a PPC form,  $\mu_F$  is 1.5 to about 2.5 and  $\mu_P$  is 0.3 to about 0.35. Therefore,  $\mu_R$  needs to be made into or more 0.5 or less 1.2 extent.

[0006] Thus, a separation pad needs to be designed so that coefficient-of-friction  $\mu_R$  may become the suitable range. In order to attain suitable coefficient-of-friction  $\mu_R$ , the separation pad is usually formed from rubber (for example, polyurethane, natural rubber, chloroprene rubber, etc.). And by grinding a front face, surface roughness is raised and coefficient of friction is adjusted. Such a separation pad is indicated by for example, JP,62-2183,Y, JP,8-634,B, the patent No. 2505945 official report, etc.

[0007] However, there is room of amelioration in the separation pad made of rubber in a wear-resistant field. That is, when the separation pad made of rubber is used for a long period of time, a front face may be worn out, coefficient-of-friction  $\mu_R$  may fall, and the double feed of paper leaf may occur. Moreover, there is also a possibility that a feed roller may contact the substrate of a separation pad as abrasion loss is large. With the separation pad (for example, reference, such as the patent No. 2652562 official report) with which fillers, such as a staple fiber, were blended with rubber in order to rationalize coefficient-of-friction  $\mu_R$  especially, sufficient abrasion resistance is hard to be obtained.

[0008] The separation pad with which it replaced with rubber and thermoplastic elastomer was used is also proposed (for example, reference, such as JP,8-324818,A). Generally the separation pad made from thermoplastic elastomer is excellent in abrasion resistance compared with the separation pad made of rubber.

[0009]

[Problem(s) to be Solved by the Invention] However, in order to attain suitable coefficient-of-friction  $\mu_R$  in the separation pad made from thermoplastic elastomer, there is much constraint in the field of ingredient selection. Moreover, this thermoplastic elastomer receives various constraint even in the field of workability. Though it is a product made of bridge formation rubber, it excels in abrasion resistance, and a separation pad with which suitable coefficient-of-friction  $\mu_R$  is moreover attained is desired in the commercial scene.

[0010] It replaces with a separation pad depending on the class of feed device, and a separation roller may be formed. Moreover, a separation sheet is attached in a tray and the feed device constituted so that this separation sheet and a feed roller might contact also exists. Also in these separation rollers and a separation sheet, coexistence with abrasion resistance and suitable coefficient-of-friction  $\mu_R$  is desired like the above-mentioned separation pad.

[0011] This invention is made in view of such the actual condition, is excellent in abrasion resistance, and sets offer of the paper leaf double-feed-prevention member by which suitable coefficient-of-friction  $\mu_R$  is moreover attained easily as the purpose.

[0012]

[Means for Solving the Problem] the paper leaf double-feed-prevention member which comes to construct a bridge over the rubber constituent with which invention for which achievement of this purpose was benefited contains 5 or more sections the ultra high molecular weight polyethylene of the 100 or less section to the base material rubber and this base material rubber 100 section -- it comes out.

[0013] Since this paper leaf double-feed-prevention member contains ultra high molecular weight polyethylene, though it is a product made of bridge formation rubber, it excels in abrasion resistance. Moreover, since this paper leaf double-feed-prevention member is a product made of bridge formation rubber, coefficient-of-friction  $\mu_R$  with it is attained easily. [ the high therefore design degree of freedom of coefficient of friction and ] [ suitable ]

[0014] Preferably, the weight average molecular weight of the ultra high molecular weight polyethylene blended is 1 million or more. Thereby, a paper leaf double-feed-prevention member demonstrates the more excellent abrasion resistance.

[0015] Preferably, the loadings of ultra high molecular weight polyethylene are 10 or more-section the 50 or less section to the base material rubber 100 section. While a paper leaf double-feed-prevention member demonstrates the more excellent abrasion resistance by this, the workability in the production process of a paper leaf double-feed-prevention member improves.

[0016] Preferably, base material rubber uses an ethylene-propylene-diene copolymer (EPDM) as a principal component. Thereby, the weatherability of a paper leaf double-feed-prevention member improves.

[0017]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained in full detail, a drawing being referred to suitably.

[0018] Drawing 1 is the typical sectional view in which the feed device 3 in which the

separation pad 1 as a paper leaf double-feed-prevention member concerning 1 operation gestalt of this invention was used was shown. This feed device 3 is equipped with the separation pad 1, the tray 5, and the feed roller 7. The separation pad 1 and the tray 5 are estranged. It is fixed to the substrate 9 and the separation pad 1 has countered with the feed roller 7. When the feed roller 7 rotates in the direction shown by the arrow head R in drawing, one paper leaf 11 on a tray 5 is sent out at a time towards an image formation device (not shown).

[0019] This separation pad 1 is a rubber Plastic solid with which it comes to construct a bridge over a rubber constituent. A bridge formation rubber Plastic solid has comparatively high coefficient of friction at the time of sliding with paper leaf. Moreover, adjustment of coefficient of friction is easily made by adjustment of the loadings of a bulking agent, adjustment of surface roughness, etc., and it deals in a bridge formation rubber Plastic solid. Therefore, suitable coefficient-of-friction  $\mu_R$  is attained with this separation pad 1.

[0020] As base material rubber of a rubber constituent, natural rubber, EPDM, polybutadiene, a styrene-butadiene copolymer, polyisoprene, an acrylonitrile-butadiene copolymer, ethylene propylene rubber, polyurethane, chloroprene rubber, acrylic rubber, silicone rubber, chlorosulfonated polyethylene, etc. are used, and it gets.

[0021] Especially suitable rubber is EPDM. Since the principal chain of EPDM consists of saturated hydrocarbon, a double bond is not included in this principal chain. For this reason, even if EPDM is put for a long time to the bottom of environments, such as a high concentration ozone ambient atmosphere and a beam-of-light exposure, molecule principal chain cutting cannot take place easily (that is, it excels in weatherability). Although ozone may occur in a copying machine at the time of image formation, ozone degradation of the separation pad 1 is controlled by using EPDM.

[0022] EPDM and other rubber may be used together. Even in this case, it is desirable that the viewpoint of weatherproof maintenance of the separation pad 1 to EPDM is the principal component of base material rubber. It is desirable that the ratio of EPDM occupied to all base material rubber is specifically carried out to more than 80 mass % more than 50 mass % more than 30 mass % especially at a pan. Since the ratio which EPDM in all base material rubber occupies from a weatherproof viewpoint is so desirable that it is high, especially this upper limit is not prescribed by this invention.

[0023] Although EPDM of the non-oil-extended type which consists only of a rubber component, and EPDM of the oil exhibition type which contains extender oil with a rubber component exist in EPDM, any EPDM of a type may be used in this invention. In addition, when oil exhibition type EPDM is used, the ratio which the rubber

component except extender oil occupies to all base material rubber should just be carried out to more than above 50 mass % (preferably more than 80 mass %).

[0024] Ultra high molecular weight polyethylene is contained in the rubber constituent. The weight average molecular weight by which ultra high molecular weight polyethylene was measured based on ASTM-D 4020 is the thing of 500,000 or more polyethylene. Although ultra high molecular weight polyethylene is the amount of macromolecules therefore, it is excellent in a mechanical strength. The abrasion resistance of the separation pad 1 improves by including ultra high molecular weight polyethylene. Moreover, the degree of hardness of the separation pad 1 is adjusted by combination of ultra high molecular weight polyethylene, and coefficient of friction  $\mu_R$  is made the suitable range by this, and gets by it.

[0025] The loadings of ultra high molecular weight polyethylene are 5 or more section the 100 or less section to the base material rubber 100 section. When loadings are the less than 5 sections, the abrasion resistance of the separation pad 1 may become inadequate. From this viewpoint, the 10 or more sections of loadings are desirable, and especially its 15 or more sections are desirable. On the contrary, when loadings exceed the 100 sections, the workability in the production process of the separation pad 1 may worsen. From this viewpoint, the 50 or less sections of loadings are desirable, and especially its 35 or less sections are desirable. In addition, the numeric value shown in the "section" in this specification means a ratio when mass is made into criteria.

[0026] It is desirable that 1,800,000 or more ultra high molecular weight polyethylene is especially blended for weight average molecular weight 1 million or more. The abrasion resistance of the separation pad 1 improves, so that weight average molecular weight is high. Moreover, since the loadings of ultra high molecular weight polyethylene are set up few and it gets so that weight average molecular weight is high, workability may improve. In addition, although there is especially no upper limit of weight average molecular weight, the weight average molecular weight of the ultra high molecular weight polyethylene usually obtained is 6 million or less.

[0027] Other thermoplastic polymers may be blended with ultra high molecular weight polyethylene. The thermoplastic elastomer equipped with the polyethylene which is not ultra high molecular weight polyethylene, polypropylene, ionomer resin, a polyamide, polystyrene, a polycarbonate, polyacetal, acrylic resin, the soft segment, and the hard segment as a thermoplastic polymer in which it is blended and deals is mentioned.

[0028] It is not restricted, but known bridge formation gestalten, such as peroxide bridge formation and sulfur bridge formation, are adopted, and it deals especially in the bridge formation gestalt of a rubber constituent. Since it says that the compression

set of the separation pad 1 becomes small especially, peroxide bridge formation is desirable. As a desirable peroxide, it is dicumyl peroxide, 1, and 1-screw (the third butylperoxy), for example. - 3, 3, a 5-trimethyl cyclohexane, G tertiary butyl peroxide, tertiary butyl cumyl peroxide, 2, the 5-dimethyl -2, 5-JI (third butylperoxy) hexane, etc. are mentioned. Especially the loadings of a peroxide have the 4 or less desirable section more than per section 0.5 or more-section the 7 or less section to the base material rubber 100 section.

[0029] A bulking agent may be blended with a rubber constituent. Adjustment of coefficient-of-friction  $\mu_R$  is made by combination of a bulking agent, and it gets. As a desirable bulking agent, silicon oxide, a calcium carbonate, carbon black, clay, talc, a barium sulfate, the diatom earth, etc. are mentioned. Especially the loadings of a bulking agent have 20 or more-section the 50 or less desirable section 10 or more-section the 60 or less section to the base material rubber 100 section.

[0030] Optimum dose addition of the additives, such as a reinforcing agent, a coloring agent, a softener, an antioxidant, and reinforcement fiber, may be carried out further at a rubber constituent if needed.

[0031] A rubber constituent is obtained by kneading base material rubber, ultra high molecular weight polyethylene, a cross linking agent, various additives, etc. This rubber constituent is fed into metal mold, and the separation pad 1 is obtained by being heated and pressurized (compression forming). Of course, the separation pad 1 may be fabricated by the shaping approaches, such as an injection-molding method. This separation pad 1 constructs a bridge with heating (namely, hardening), is this semantics and essentially differs from the separation pad (namely, separation pad fused with heating) which a bridge formation rubber particle becomes from the thermoplastic elastomer distributed in the thermoplastic polymer.

[0032] At the feed device 3 in which this separation pad 1 was used, coefficient-of-friction  $\mu_P$  of coefficient-of-friction  $\mu_R$  and the paper leaf 11 of coefficient-of-friction  $\mu_F$  of the feed roller 7 and paper leaf 11, the separation pad 1, and paper leaf 11, and 11 comrades is following formula  $\mu_F > \mu_R > \mu_P$ . ... (I)

It comes out and has the relation expressed. Thereby, the double feed and the paper remainder of paper leaf 11 are prevented.

[0033] Drawing 2 is the typical sectional view in which the feed device 15 in which the separation sheet 13 as a paper leaf double-feed-prevention member concerning other operation gestalten of this invention was used was shown. This feed device 15 is equipped with the feed roller 17 and the tray 19. The separation sheet 13 is formed in the feed roller 17 approach of the top face of a tray 19. the top face of a tray 19 .. many

-- the paper leaf 11 of several sheets piles up and is stored. With the spring (not shown) which contacts the inferior surface of tongue, the feed roller 17 approach of a tray 19 is pushed up up, and is forced toward the feed roller 17. Between the separation sheet 13 and the feed roller 17, a part for the point of paper leaf 11 is inserted. When the feed roller 17 rotates in the direction shown by the arrow head R in drawing, one paper leaf 11 is sent out at a time towards an image formation device (not shown).

[0034] The separation sheet 13 is formed by constructing a bridge over the rubber constituent which contains 5 or more sections the ultra high molecular weight polyethylene of the 100 or less section to the base material rubber and this base material rubber 100 section as well as the separation pad 1 shown in drawing 1 . Therefore, suitable coefficient-of-friction  $\mu_R$  is attained with this separation sheet 13. Moreover, this separation sheet 13 is excellent in abrasion resistance.

[0035] It replaces with the separation pad 1 (refer to drawing 1 ), and the feed device in which the separation roller was formed also exists. Moreover, the feed device equipped with both the separation pad 1 and the separation sheet 13 also exists. The abrasion resistance improves by using the separation pad 1 of drawing 1 , and the same polymer constituent for these paper leaf double-feed-prevention members (a separation pad, a separation roller, separation sheet, etc.) in any case.

[0036]

[Example] The thing for which this invention should be hereafter interpreted restrictively based on the publication of this example although clear [ of the effectiveness of this invention ] is carried out by the example and which do not come out is natural.

[0037] The [example 1] EPDM(trade name of Sumitomo Chemical Co., Ltd. "S PUREN 586")100 section, Weight average molecular weight The ultra-high-molecular-weight-polyethylene (trade name of Mitsui Chemicals, Inc. "MIPERON XM-220") 5 section of about 2 million, The silicon oxide (trade name of Japanese silica company "nip seal VN3") 15 section, The calcium-carbonate (\*\*\*\* powdering trade name of shrine "BF300") 30 section, the titanium oxide (trade name of Titan Kogyo K.K. "Cronos KR380") 2 section, The carbon black (trade name of Tokai Carbon Co., Ltd. "C strike SO") 1 section and the dicumyl peroxide (trade name of Nippon Oil & Fats Co., Ltd. "Park Mill D") 3 section were kneaded, and the rubber constituent was obtained. This rubber constituent was fed into metal mold, it heated and pressurized for 20 minutes under the temperature of 170 degrees C, and the bridge formation rubber sheet whose width of face is 50mm, whose die length is 200mm and whose thickness is 2mm was obtained. This rubber sheet was sliced in thickness of

1.2mm, it judged in the rectangle whose width of face is 10mm further and whose die length is 60mm, and the separation pad of an example 1 was obtained.

[0038] [Example 1 of comparison] ultra high molecular weight polyethylene was not blended at all, and also the separation pad of the example 1 of a comparison was obtained like the example 1.

[0039] The variate of the loadings of an example 2 and [example 2 of comparison] ultra high molecular weight polyethylene was carried out as shown in the following table 1, and also the separation pad of an example 2 was obtained like the example 1.

[0040] Although the variate of the loadings of [example 2 of comparison] ultra high molecular weight polyethylene was carried out as shown in the following table 1, and also it was going to obtain the separation pad of the example 2 of a comparison like the example 1, since kneading was not completed, the prototype was stopped.

[0041] [Example 3] weight average molecular weight replaced with the ultra high molecular weight polyethylene of 2 million, and weight average molecular weight blended about 6 million ultra high molecular weight polyethylene (trade name of Mitsui Chemicals, Inc. "high ZEKKUSU million 630M"), and also the separation pad of an example 3 was obtained like the example 1.

[0042] The [example 3 of comparison] weight average molecular weight replaced with the ultra high molecular weight polyethylene of 2 million, and weight average molecular weight blended about 50,000 polyethylene (trade name of Mitsui Chemicals, Inc. "ULTZEX 2005HC"), and also the separation pad of the example 3 of a comparison was obtained like the example 1.

[0043] The extender oil of [example 4 of comparison] 50 mass % extruded EPDM (trade name of Sumitomo Chemical Co., Ltd. "670F") by which the oil exhibition was carried out using the twin screw extruder ("2TR-75" of MORIYAMA), and the diameter obtained the pellet whose die length is 4mm by 4mm. This pellet 140 section (rubber component 70 section) and weight average molecular weight mixed the ultra-high-molecular-weight-polyethylene (the above-mentioned "MIPERON XM-220") 5 section of about 2 million, and the polypropylene (trade name of Japan Polychem "nova tech PP BC-6") 30 section with the tumbler, and supplied to the twin screw extruder ("HTM38" of eye BEKKU). from another input port, supplied the bromination alkylphenol formaldehyde resins (trade name of Taoka chemistry company -- "... tacky roll 250-III") 8.4 section as a resin cross linking agent, and kneaded at 180 degrees C, dynamic bridge formation was made to perform, and the thermoplastic-elastomer constituent was obtained. This thermoplastic-elastomer constituent was extruded in the shape of a ribbon (width of face of 30mm, thickness of 3mm), and it sliced so that

thickness might be set to 1.2mm after cooling. It judged in the rectangle whose width of face is furthermore 10mm and whose die length is 60mm, and the separation pad of the example 4 of a comparison was obtained.

[0044] What has been kneaded in the kneading process of [evaluation of workability] above-mentioned was made into "O", and kneading made "x" what made a little difficult thing "\*\*\*\*" and was not able to knead it. This result is shown in the following table 1.

[0045] The coefficient-of-friction measurement machine (trade name "try BOGIA of a new east science company TYPE:HEIDON-14DR") of [measurement of starting friction multiplier] Hayden 14 mold was prepared. And coefficient-of-friction  $\mu_R$  of the paper leaf double-feed-prevention member in a new article phase was measured, using the pro par bond paper of a canon company as measurement paper. The load at the time of measurement was set to 1.96 Ns, and the rate was made into 600 mm/min. This result is shown in the following table 1.

[0046] the separation pad of [measurement of abrasion loss] each example, and the example of a comparison -- a printer (trade name of a canon company "LBP470") -- equipping -- a PPC form (trade name of a canon company "pro par bond paper") -- a 50000-sheet copy -- paper was carried out. And the mass of the separation pad before and behind \*\*\*\* was measured, and the abrasion loss of a separation pad was computed from the difference. This result is shown in the following table 1. In addition, the separation pad whose abrasion loss is 35mg or less is desirable.

[0047] In \*\*\*\* for abrasion loss measurement of [observation of \*\*\*\* situation] above-mentioned, visual observation of the \*\*\*\* situation (existence of generating of a double feed) was carried out in the phase which \*\*\*\*(ed) 1000 sheets of PPC forms of the beginning. What the double feed has not generated was made into "O." This result is shown in the following table 1.

[0048]

[Table 1]

[0049] In Table 1, the separation pad of each example has little abrasion loss compared with the separation pad of each example of a comparison. This is because the separation pad of each example is excellent in abrasion resistance. Moreover, suitable coefficient-of-friction  $\mu_R$  is attained in the separation pad of each example. The predominance of this invention was checked from this evaluation result.

[0050] As mentioned above, although effectiveness by combination of ultra high

molecular weight polyethylene was clarified the separation pad having been used as an example, the same effectiveness is acquired by combination of ultra high molecular weight polyethylene also in a separation roller, a separation sheet, etc.

[0051]

[Effect of the Invention] As explained above, the paper leaf double-feed-prevention member of this invention is excellent in abrasion resistance, though it is a product made of bridge formation rubber. Moreover, suitable coefficient-of-friction  $\mu_R$  is attained in this paper leaf double-feed-prevention member. By using this paper leaf double-feed-prevention member for a feed device, the double feed and the paper remainder of paper leaf are prevented over a long period of time.